

What is claimed is:

1. A method for wireless communication between a first communication device and a second communication device, comprising:
 - a. at a first communication device:
 - i. receiving at a plurality of antennas signals transmitted by the second communication device;
 - ii. determining a receive weight vector comprising a plurality of complex receive antenna weights for the plurality of antennas of the first communication device from the received signals;
 - iii. computing a transmit weight vector by computing a conjugate of the receive weight vector, the transmit weight vector comprising a complex transmit antenna weight for each of plurality of antennas of the first communication device, wherein each complex transmit antenna weight has a magnitude and a phase whose values may vary with frequency across a bandwidth of the baseband signal, thereby generating a plurality of transmit signals each of which is weighted across the bandwidth of the baseband signal to be transmitted from corresponding ones of the plurality of antennas to the first communication device, wherein the magnitude of the complex transmit antenna weight associated with each antenna is such that the power to be output at each antenna is the same and is equal to the total power to be output by all of the plurality antennas divided by the number of antennas and such that the sum of the power at each corresponding frequency across the plurality of transmit signals is equal to a constant; and
 - iv. applying the transmit weight vector to a baseband signal for transmission via the plurality of antennas of the first communication device to the second communication device;
 - b. at the second communication device:
 - i. receiving at a plurality of antennas signals transmitted by the first communication device;

- ii. determining a receive weight vector comprising a plurality of complex receive antenna weights for the plurality of antennas of the second communication device from the received signals;
 - iii. computing a transmit weight vector by computing a conjugate of the receive weight vector, the transmit weight vector comprising a complex transmit antenna weight for each of plurality of antennas of the second communication device, wherein each complex transmit antenna weight has a magnitude and a phase whose values may vary with frequency across a bandwidth of the baseband signal, thereby generating a plurality of transmit signals each of which is weighted across the bandwidth of the baseband signal to be transmitted from corresponding ones of the plurality of antennas to the second communication device, wherein the magnitude of the complex transmit antenna weight associated with each antenna is such that the power to be output at each antenna is the same and is equal to the total power to be output by all of the plurality antennas divided by the number of antennas and such that the sum of the power at each corresponding frequency across the plurality of transmit signals is equal to a constant; and
 - iv. applying the transmit weight vector to a baseband signal for transmission via the plurality of antennas of the second communication device to the first communication device;
 - c. wherein the first communication device repeats the steps of determining and computing each time signals are received from the second communication device to update the transmit weight vector for transmitting to the second communication device, and the second communication device repeats the steps of determining and computing each time signals are received from the first communication device to update the transmit weight vector for transmitting to the first communication device.
2. The method of claim 1, wherein the bandwidth of the baseband signal processed by each of the first and second communication devices comprises K plurality of frequency sub-bands, and the magnitude of the complex transmit antenna weights

associated with each of the plurality of antennas of the respective communication device is such that the power to be output by each antenna is the same and is equal to $1/(KN)$ of the total power to be output for all of the K frequency sub-bands, where N is the number of antennas of the respective communication device.

3. The method of claim 1, wherein steps (ii) through (iv) at each of the first and second communication devices are performed for each of K frequency sub-bands of the baseband signal that correspond to sub-carriers of a multi-carrier baseband signal or synthesized frequency sub-bands of a single carrier baseband signal.
4. The method of claim 21, and further comprising storing in the first communication device, for each of the N antennas, complex transmit antenna weights for a subset of the K frequency sub-bands or sub-carriers.
5. The method of claim 22, and further comprising retrieving the stored subset of complex transmit antenna weights and generating therefrom the complete set of antenna weights for all of the K frequency sub-bands or sub-carriers using interpolation techniques.
6. A method for wireless communication between a first communication device and a second communication device, comprising:
 - a. at the first communication device, processing a baseband signal to be transmitted with transmit antenna weights to transmit beamform the corresponding signal via a plurality of antennas to the second communication subject to a constraint such that the power emitted by each of the antennas is the same; and
 - b. at the second communication device, processing a baseband signal to be transmitted with transmit antenna weights to transmit beamform the corresponding signal via a plurality of antennas to the first communication subject to a constraint such that the power emitted by each of the antennas is the same.
7. The method of claim 6, wherein at the first communication device, receiving at the plurality antennas of the first communication device transmitted from the second communication device, and deriving the transmit antenna weights used by the first communication device to transmit to the second communication device

based on the received signals, and at the second communication device, receiving at the plurality antennas of the second communication device transmitted from the first communication device, and deriving the transmit antenna weights used by the first communication device to transmit to the second communication device based on the received signals

8. The method of claim 7, wherein at the first communication device, the step of deriving the transmit antenna weights comprises computing a conjugate of a receive weight vector derived from signals received at the first communication device from the second communication device, and wherein at the second communication device, the step of deriving the transmit antenna weights comprises computing a conjugate of a receive weight vector derived from signals received at the second communication device from the first communication device.
9. The method of claim 7, wherein the bandwidth of the baseband signal processed by each of the first and second communication devices comprises K plurality of frequency sub-bands, and the magnitude of the complex transmit antenna weights associated with each of the plurality of antennas of the respective communication device is such that the power to be output by each antenna is the same and is equal to $1/(KN)$ of the total power to be output for all of the K frequency sub-bands, where N is the number of antennas of the respective communication device.
10. The method of claim 7, wherein at the first communication device, repeating the step of deriving the transmit weights each time signals are received from the second communication device to update the transmit weights for transmitting back to the second communication device, and wherein at the second communication device, repeating the step of deriving the transmit weights each time signals are received from the first communication device to update the transmit weights for transmitting back to the first communication device.